SECTION 4: Energy

Principles

- Energy should be used to maximize the community's well-being, taking into consideration technological effectiveness, cost, environmental impacts, and social equity.
- Given that existing buildings consume the bulk of energy, retrofitting them should be a priority.
- Renewable energy provides a way to meet the community's energy needs with few or no GHG emissions.
- As natural gas emits less GHGs than other fossil fuels, it can serve as a transition fuel.
- Efforts to promote energy efficiency and renewable energy are needed to compensate for imperfect market signals that do not reflect the actual costs to the environment and society of energy production and use.
- Since climate change is underway, the future energy system should better enable the community to adapt to impacts and to changes in energy availability.

The Role of Energy in Cambridge's GHG Emissions

According to the GHG emissions inventory, energy used to heat and cool buildings, provide lighting, and power equipment accounted for 87% of Cambridge's GHG emissions in 1998. (Fuel to power vehicles is addressed in the plan's transportation section.) Most of this was from the commercial/industrial sector, which accounted for 63%. To achieve the goals of this plan, this source of GHG emissions must be addressed.

The commercial/industrial sector plays a relatively large role in energy use because Cambridge is a major location for economic activity and educational institutions. The city is a net importer of jobs and contains a significant square footage of office buildings, research institutes, laboratories, and commercial establishments.

GHG Emission Factors by Fuel

Electricity *(1998)*	1.43 lb. CO_2/kwh
Heating Oil	25.2 lb. CO_2/gallon
Natural Gas	11.8 lb. CO_2/therm

Massachusetts Electric System Fuel Mix

Oil	28.7%
Coal	27.9%
Natural Gas	26.4%
Nuclear	10.9%
Hydro	1.2%
Other	5.0%

How Energy is Used and Supplied in Cambridge

Cambridge consumes energy in the form of electricity, natural gas, and fuel oil. Each form of energy is distributed differently.

Electricity for most of the community is distributed by NSTAR, which includes the Cambridge Electric Light Company, from generation sources located throughout the northeast region of the United States and Canada. Electricity comes to Cambridge over a network, or grid, of overhead and underground transmission cables. It is generated by a variety of fuels, primarily coal, oil, natural gas, nuclear, and hydropower. The impact of the electricity fuel mix varies between regions of the country and changes over time. For example, if a region relies relatively more on coal, it will emit relatively more greenhouse gases for each kilowatt-hours of electricity than a region that relies more on hydropower.

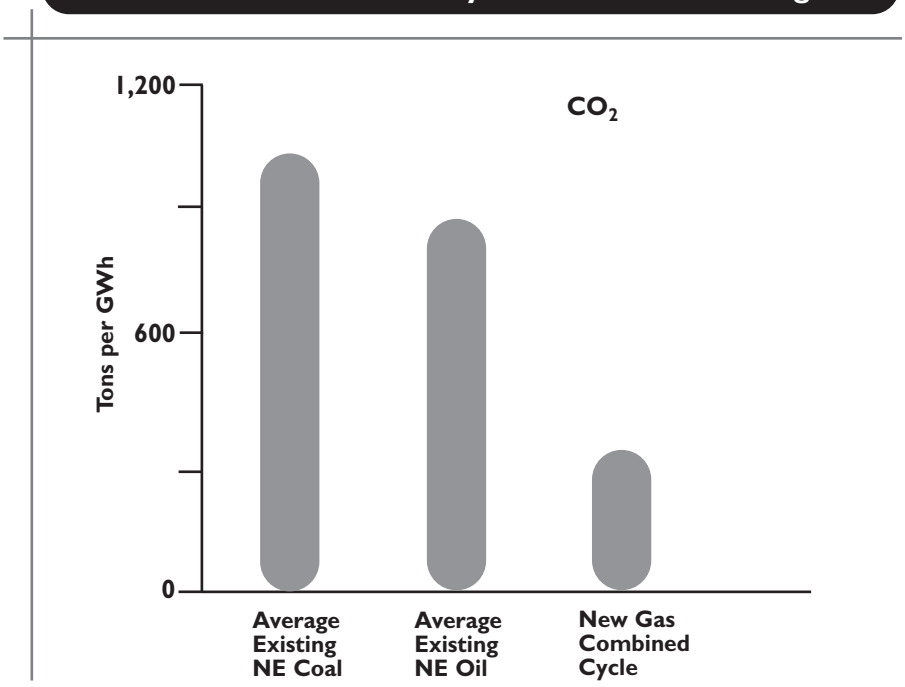
Cambridge has two electric generating facilities. The Kendall Square electric generating station owned by Mirant Corp. in East Cambridge has a 234-megawatt generating capacity. Kendall's electricity is not consumed in Cambridge directly; it is fed into the regional grid. Mirant completed construction in 2002 of an upgrade to the existing facility with a more efficient combined cycle natural gas fired turbine to bring its generating capacity up to 234 megawatts of electricity. It also continues to produce steam for district heating and industrial uses.

MIT Cogeneration Plant

MIT began operating its own 21-megawatt cogeneration facility on Vassar Street in 1995. The power plant replaced most of the electricity previously supplied by Cambridge Light Company and made the production of steam more efficient. The plant meets most of the campus' electricity needs and provides steam for heating, cooling, and chilled water. The $40 million investment is expected to save the university millions of dollars over the its life. In comparison to electricity provided by the national grid, MIT's plant significantly reduces the emission of carbon dioxide and conventional air pollutants. Based on 1998 data, the plant reduced CO_2 emissions by 76,955 tons copmared to the pre-existing situation in 1990. In addition, the conventional air pollutants are reduced by 45% or about 211 tons per year, which is equivalent to the pollution emitted by about 13,000 average round trips into Cambridge per day.

For more information view the website at http://cogen.mit.edu

GHG Emissions of Electric System Fuels in New England



MIT owns the second facility, a 22-megawatt cogeneration plant that generates most of the university's electricity. By regulation, MIT is not allowed to sell its electricity to the regional grid system. In addition to electricity, the facility generates steam for heating, cooling, and chilled water. GHG reductions associated with MIT's facility are discussed in the sidebar.

Natural gas is also distributed by NSTAR, through its subsidiary Commonwealth Gas Company. In New England, natural gas arrives through transmission pipelines from Canada, the Gulf of Mexico, and Texas. A network of underground pipelines conveys the natural gas to buildings and other facilities around the city. Natural gas consists primarily of methane, which is a potent greenhouse gas, but it tends to release less GHG per unit of energy used than other fossil fuels. Switching to natural gas can be seen as a bridge to a non-fossil fuel economy that could be based primarily on hydrogen and renewable energy resources.

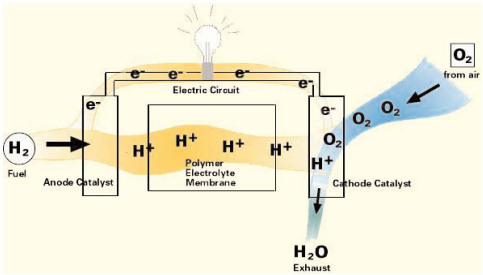
Fuel oil comes in different grades and is used for different purposes. It is used in individual boilers and furnaces to heat buildings and run large commercial boilers to generate steam in power plants. In Cambridge, fuel oil is distributed by independent dealers, and it is difficult to determine with precision how much fuel oil is consumed here. For this plan, fuel oil consumption was estimated using census figures and U.S. Department of Energy statistics.

Renewable energy is generally defined to include solar, wind, geothermal, low-emission biomass, and low-impact hydropower. Some types of renewable energy, such as large-scale hydropower, have significant negative environmental impacts that must be considered. Currently, renewable energy supplies less than 1% of New England's energy needs, but promises to become a growing sector. Technological advances and rapidly decreasing costs are making renewable energy competitive with conventional energy. An independent eco-label, called "Green-E," has been established to certify electricity based on environmental criteria.

The fuel cell is another technology for producing electricity with reduced GHGs. Chemical energy from hydrogen is transformed into electricity without the need for combustion and with virtually no carbon dioxide emissions. The hydrogen combines with oxygen from the atmosphere to drive the process. The source of hydrogen can be water, but in the near term natural gas, ethanol, and petroleum products are likely to serve as the source. Applications of fuel cells are being developed for automobiles, premium power, and small electronic devices. In the long term, fuel cells may serve as the primary source of electricity for many buildings, including residences.

Fuel Cells

Basically, a fuel cell works like a battery. Oxygen passes over one electrode and hydrogen over the other, generating electricity, water, and heat. Unlike a battery, a fuel



cell does not run down or require recharging, as long as fuel is supplied to it. A hydrogen-based fuel cell emits only water and heat. In addition to the environmental benefits, fuel cells are more reliable than conventional grid electricity. Banks, credit card companies, Internet servers, and public safety agencies, which are willing to pay higher prices for electricity to avoid interruptions, are current users of the technology.

The Massachusetts Water Resources Authority installed the first fuel cell in New England at its Deer Island Wastewater Treatment Facility in 1997; the 200 kw fuel cell runs on sewage sludge gas. New York city installed a fuel cell at the Central Park police station to avoid installation of power lines through the historic park; a fuel cell was also installed in the nation's first "green" skyscraper at 4 Times Square. In Cambridge, the MRET has awarded grants to Cambridge Savings Bank to plan for fuel cell installlations at one or more of its facilities and to Source One, Inc. and Laverty Lohnes Properties to plan for an installation at an Internet data center in Kendall Square.

Strategic Approaches

GHG emissions associated with energy use can be reduced by using less energy and by converting from fossil fuels to sources of energy that emit fewer GHGs or none at all.

For the purposes of this plan, using less energy means achieving higher efficiency—accomplishing the same task with a lower amount of energy. Fortunately, myriad measures to increase energy efficiency are available, such as increasing building insulation; improving window glazing; installing more efficient heating, ventilation, and air conditioning (HVAC) equipment; and using more lighting, appliances, and equipment.

The deployment of these energy efficiency measures requires education and publicity about the technologies and their costs and benefits. Financial incentives could further encourage the public and businesses to adopt these measures.

Energy System Trends

Electric Utility Deregulation

The energy marketplace is changing, especially in respect to electricity. In 1997, Massachusetts enacted the Electric Utility Restructuring Act, which changed the way the generation of electricity is regulated. As a result, utilities such as Commonwealth Energy (an NSTAR company), of which Cambridge Electric Light Company is a subsidiary, sold off their generating assets and became solely distributors of electricity. The act seeks to create a competitive marketplace for electricity similar to the market that now exists for telephone service. *The major features of the act are:*

- By 2005, market forces rather than the Department of Telecommunications and Energy (DTE) will determine the price of electricity. Until then the DTE is gradually raising the standard offer price of electricity.
- Beginning in 2003, 1% of the utilities' generation portfolio must be renewable energy. The proportion increases to 4% by 2009. This requirement is called the Renewable Portfolio Standard (RPS). It is estimated that by 2009, about 2 million megawatt-hours of electricity will be produced, which would double the electricity generated from renewable sources in New England.
- The act established the Renewable Energy Trust Fund, described in the "Systems Benefit Charges" sidebar.

These regulatory changes have increased the pace of adding generation capacity in New England. About 21,500 megawatts of new generating capacity was proposed or under construction in New England as of the summer of 2000. All of the new plants are designed to run on cleaner burning natural gas. Combined cycle gas turbines are significantly more efficient than older generating facilities

System Benefit Charges

When consumers pay their electricity bills, state law requires utilities to include small surcharges to support energy conservation and renewable energy projects. NSTAR customers pay 0.25 cents per kilowatt-hour for energy conservation services offered through NSTAR. This amounts to about $6 on the average residential coustomer's annual utility bill. A benefits charge of 0.0075 cents per kilowatt-hour is also added for renewable energy projects. These funds are collected for the Massachusetts Renewable Energy Trust Fund, which provides grants and financing to solar, wind, fuel-cell, landfill gas and other alternative energy projects.

that run on coal, petroleum, and nuclear energy. Compared to coal and oil, they also emit less air pollution, including carbon dioxide, per unit of energy. It is expected that these new, more efficient generating facilities will out-compete and replace older facilities. If this happens, the emission of carbon dioxide associated with electricity consumption will decline.

Appliance Standards

The federal government has raised energy efficiency standards for clothes washers, water heaters, commercial heating and cooling equipment, and residential central air conditioners and heat pumps. Central air conditioning and heat pumps must become 20% more efficient. Nationally, this will save the energy output equivalent to 37 power plants.

The new clothes washer standard requires washers to be 22% more efficient by 2004 and 35% more efficient by 2007. The federal Department of Energy estimates that the new standard will save over 7,000 gallons of water a year for the average consumer and $48 annually in utility bills for energy to heat water. Nationally, DOE estimates that the new standard will save the equivalent of the energy output of 12 new 400-megawatt power plants.

The new water heater standard requires gas heaters to be 8% more efficient and electric heaters 4% more efficient. This will save the equivalent of the energy output of 37 new power plants.

Energy Demand Trends

Electricity

According to NSTAR, demand for electricity is increasing. From 1990 to 1998, electricity consumption in Cambridge increased by 17,832,000 kwh or 12.2%. The 1998 figure does not include the output of MIT's co-generation facility, which went on line in 1995. By 2010, electricity consumption in Cambridge is projected to increase to 190 million kwh, or 30% above 1990.

Natural Gas

The consumption of natural gas in Cambridge decreased from 38,329,279 therms in 1990 to 34,555,539 therms in 1998. The reasons for this decrease are not clear, but natural gas is used significantly as a heating fuel. Weather can affect usage. However, NSTAR projects that natural gas consumption will increase to 52,114,219 therms in 2010, an increase of about 36% from 1990.

Cambridge Housing Authority Saves Energy

Since 1995, CHA has been upgrading its housing facilities to save energy and money. Improvements have been made to over 1,000 housing units with new energy efficient lighting and refrigerators, air conditioning covers, degree-limiting thermostats, heating zone valves and controls, pipe insulation, and weather stripping. At the Daniel F. Burns Apartments, a 199-unit elderly housing development in North Cambridge, the all-electric heat and hot water systems were converted to gas. The total annual utility bill decreased from $1,870 per unit to $876 per unit, resulting in total savings of over $197,000. CHA hopes to convert the 303-unit Millers River Apartments in East Cambridge as well, which would reduce electricity use by 3,817,969 kwh annually.

Reduction in electricity use: 3,032,587 kwh

Reduction in natural gas use: 113,566 therms

Reduction in GHG emissions: 2,338 tons CO_2 per year

Oil

Unlike electricity and natural gas, fuel oil is distributed by independent dealers, and no central organization meters its consumption. Fuel oil data used in this plan are derived from U.S. DOE statistics, which indicate use decreased from 1990 to 1998. Based on this, we estimate that Cambridge fuel oil consumption dropped from about 11.5 million gallons in 1990 to about 9.5 million gallons in 1998, an 18% decrease. Projections of fuel oil use in 2010 are not available, so for the purposes of the GHG emission inventory, we assumed that consumption would remain at 1990 levels in 2010. This is reasonable given that many buildings are converting from fuel oil to natural gas for heating and hot water.

Tools and Resources

Massachusetts Renewable Energy Trust Fund

Under the Electric Utility Restructuring Act of 1997, the legislature established the Renewable Energy Trust Fund, which is administered by the Massachusetts Technology Collaborative. The MTC is a quasi-state agency based in Westborough.

The fund receives the proceeds of the system benefits charges paid by consumers and collected by utilities (0.00075 cents per kwh). To date about $150 million has been collected. Some of the funds are earmarked for one-time grants to communities tied by contract to purchase power generated by waste incineration.

Energy Conservation Funds

Consumers contribute a portion of their electricity charges to activities to reduce or avoid electricity consumption. The current charge is 0.25 cents per kwh. In 1999, ratepayer-funded energy efficiency expenditures totaled $125 million and saved 272 million kwh in Massachusetts. The Massachusetts Division of Energy Resources estimates that energy efficiency programs were cost effective by a ratio of 1.5 to 1.

In Cambridge, NSTAR disburses the energy conservation funds through its demand-side management program. NSTAR offers a variety of conservation services to consumers including residential, commercial, and industrial energy audits and programs to improve the efficiency of lighting, heating and cooling, appliances, industrial processes, and other energy uses. The NSTAR website, www.nstaronline.com, provides up-to-date information about current programs and rebate offers.

Solar Air Heating

Houghton Place Apartments installed 840 square feet of SOLARWALL panels on the south side of the penthouse. The system pre-heats ventilation air for the building's common areas. It saves 2,000 therms of natural gas yearly, a 12-ton annual reduction in greenhouse gas emissions. The system also saves $1,500 a year in energy costs. The developer was able to take advantage of a federal 10% investment tax credit and a depreciation credit.

Energy Star

The U.S. Environmental Protection Agency's Energy Star program provides a variety of tools to measure energy use in buildings and products and to recognize superior performance. The EPA evaluates products for their energy performance and awards the Energy Star label to those that meet its criteria. This provides consumers with a guide to compare products for their energy attributes.

The EPA also awards the Energy Star label to commercial and industrial buildings that perform above the agency's criteria. The designation is contingent on use of the EPA's energy benchmarking tool and monitoring of actual energy consumption. Residences can be awarded an Energy Star Homes designation, which qualifies the owners for utility rebates on high-efficiency major appliances and high-efficiency natural gas heating and water heating equipment.

The Energy Star program provides a process for businesses and institutions and other organizations to become partners and make a commitment to the program's goals. The City is a partner in the Energy Star program.

Energy Star

The EPA launched its Energy Star program in 1992 to raise consumer awareness about energy performance in products and buildings.

Currently, 30 product categories, such as lighting, consumer electronics, roofs, and heating and cooling equipment. are rated by the EPA. Those products that carry the Energy Star label arte significantly more efficient than required by minimum government standards.

Energy Star buildings are in the nation's top 25% in terms of energy efficiency.

Energy Star partners, which can be businesses or other types of organizations, have entered into agreements with the EPA to undertake energy efficiency improvements and promote good energy practices.

DOE 1605(b) Voluntary GHG Reporting Program

The DOE maintains a system for businesses and institutions to report their voluntary reductions of GHG emissions. Congress created the 1605(b) voluntary GHG reporting program through the Energy Policy Act of 1992. Nationwide in 2000, 222 firms and organizations reported on 1,882 projects that reduced or sequestered 269 million tons of carbon dioxide. This reporting system can be coupled with the Energy Star program and other efforts to document emission reductions. If in the future a system for trading GHG emission credits is established, reporting emission reductions to DOE may become valuable to the participants. Some states, such as New Hampshire and California, have established GHG registries as well.

Energy Facilities Siting Board CO_2 Offset Policy

New power plant projects in Massachusetts that will create or add 100 megawatts or more of electric generating capacity are required to obtain approval from the state Energy Facilities Siting Board (EFSB). The EFSB has established a policy to require project proponents to offset the emission of CO_2 from their projects in one of several ways. Mirant's Kendall Square upgrade received EFSB approval and has started operating. Mirant's required offset will be about $250,000 paid in five installments over the first five years of the facility's operations or a one-time lump sum payment of about $200,000. Mirant has committed to working with the City to use the money to fund GHG emission reduction projects in Cambridge. These projects are subject to approval by the EFSB.

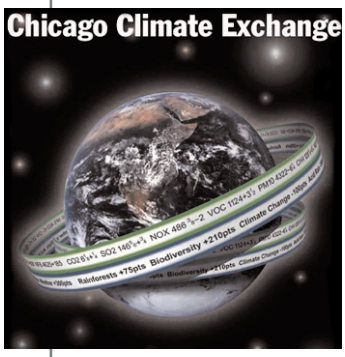
Offset funds from power plant projects in other communities might also be available for Cambridge to use.

Energy Service Companies (ESCOs)

An ESCO is a business that audits energy performance in buildings and other facilities and develops, installs, monitors, and finances projects to improve energy efficiency and maintenance costs. Typically, an ESCO is involved with projects that take from a few months to ten years to pay off. A common tool used by ESCOs is the performance contract. For example, an ESCO might organize, install, and finance replacement of lighting in a large commercial building at no cost to the property owner. In exchange, the ESCO recovers its cost and makes a profit by recouping a portion of the energy savings over a period of time according to terms agreed upon with the owner. ESCOs also operate as contractors to utilities and other entities. A number of ESCOs are active in Massachusetts.

GHG Trading

Systems are being developed to enable greenhouse gas emissions reduction credits to be traded in the marketplace as a valued commodity. The idea behind trading is to allow for cost-efficient reductions of greenhouse gases. Such trading already takes place for conventional air pollutants such as sulfur and nitrogen oxides. While these pollution credits are traded on a regional basis, greenhouse gas emissions have the potential to be traded on the international market because a quantity of greenhouse gas emitted in one area of the world is equal to that emitted in another area.



The Chicago Climate Exchange is being established to serve seven Midwestern states in 2002 with plans to expand nationally in 2003. In Massachusetts, the Department of Environmental Protection is developing a process to enable the owners of six older power plants (the so-called filthy five plus one other) to buy GHG credits to offset their emissions.

For Cambridge, the implication is that GHG reductions may become a commodity, which would create another avenue to finance actions that reduce GHG emissions.

Federal and State Renewable Energy Tax Incentives

Various federal and state tax incentives are available to support renewable energy projects. They include:

- The federal Renewable Energy Tax Credit of 1.5 cents per kwh; applicable to wind, solar photovoltaic, and biomass.
- The federal Modified Accelerated Cost Recovery System for wind, solar, and geothermal properties, which allows businesses to recover investments through depreciation deductions.
- A federal solar tax credit of 10% of purchase and installation costs.
- A Massachusetts 100% income tax deduction for solar energy systems on commercial and industrial properties.
- An exemption from Massachusetts excise taxes for solar energy systems on commercial and industrial properties.
- A 15% Massachusetts tax credit for residential renewable energy systems up to a maximum of $1,000.
- A Massachusetts sales tax exemption for residential renewable energy systems.
- Exemption of renewable energy systems from property taxes. In other words, installation of a renewable energy system does not increase the assessed value of a property.

Porter Square Shopping Plaza Goes Solar

Gravestar, Inc. completed its $13 million renovation of the shopping plaza in 1999, including several green building improvements:

- *20 KW of photovoltaic panels (PV) that produce about 22,000 KWH/year*
- *Stormwater system that recharges runoff and stores a portion for use in landscape irrigation*
- *Building energy efficiency improvements such as thicker insulation*
- *Highly reflective roof*
- *400 new trees and shrubs*

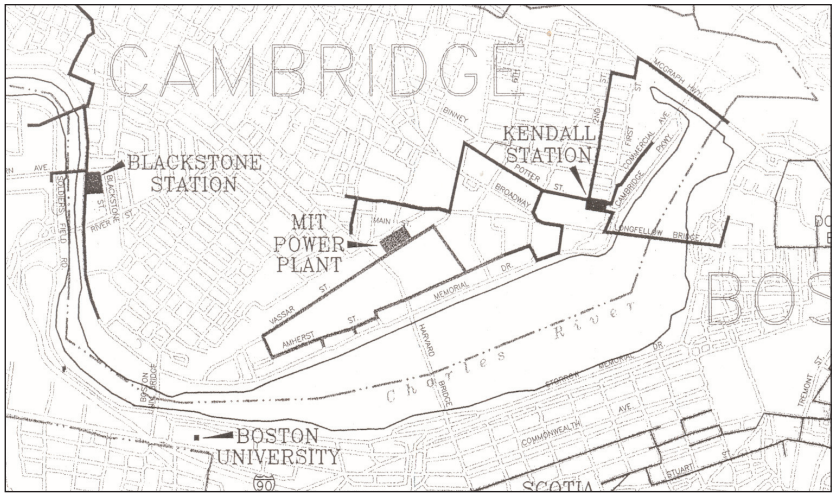
Gravestar installed an electronic kiosk in front of the complex to explain the PV system.

Energy generated by PV 22,000 kwh annually

GHG reduction by PV 15 tons CO_2 annually

Aggregation

Under the electric utility deregulation law, municipalities or groups of consumers can create aggregations to buy electricity. In addition to a lower price, aggregations can negotiate about the source of the power they buy. A contract between an aggregation and the utility could specify that all or a portion of the power be generated by renewable energy sources.



Cambridge Steam System

District Steam

Portions of Cambridge are served by steam created from cogeneration. The steam is used for industrial processes and for heating. A steam distribution system exists in East Cambridge where steam is a byproduct of the Kendall Square electric generating station owned by Mirant Corp. (formerly Southern Energy), which acquired the plant in 1999 from Commonwealth Energy. AES, Inc. operates the steam distribution system. Its clients include businesses and institutions in Cambridge and Boston such as the Museum of Science, Massachusetts General Hospital, and Amgen. Mirant has recently installed a highly efficient combined cycle natural gas-fired generator that will increase the plant's capacity to generate electricity and produce steam. The installation will also produce both much more efficiently and cleanly.

MIT's cogeneration facility also produces both electricity and steam. The steam is used for heating, cooling, and chilled water on the campus. AES operates the Blackstone Station facility located on Blackstone Street, which produces steam for Harvard University and Genzyme. This facility runs on gas and oil.

ACTIONS TO REDUCE GHG EMISSIONS

Note: Actions are classified based on which sectors of the community would be directly involved:

B=Business community
G=City government
I=Institutions
R=Residents

Proposed actions are listed by sector in Appendix III.

Strategy 1: Improve Energy Efficiency

Improvements in energy efficiency are the most cost-effective way to reduce GHG emissions. These include heating and cooling equipment upgrades, replacement of refrigerators, installation of heat pump systems, insulation, replacement of incandescent lights with compact fluorescents, energy management system controls, and many other measures. Additional building insulation, upgrades to more efficient boilers and furnaces, and other measures reduce the use of natural gas and fuel oil

Actions: 1990-2001

- The City participated in the EPA Greenlights Program, beginning in 1998, to upgrade lighting in municipal buildings with more efficient fixtures.
- Harvard University replaced approximately 7,200 halogen torchiere lamps in 1999 and 2000 with energy efficient fluorescent torchieres. In addition to the environmental and economic benefits, the project reduced the risk of fires associated with halogen lamps.
- Cambridge Housing Authority has saved 3,032,587 kwh of electricity and 113,566 therms of natural gas since 1995 through a variety of energy saving actions.
- MIT constructed a cogeneration facility in 1995 to replace electricity from the regional grid and steam from on-campus boilers.
- Mirant acquired the Kendall Square Station power plant in 1999 and upgraded it with a combined cycle gas-fired generator.
- Many businesses and residents throughout the city have undertaken energy efficiency measures in their buildings.

Boston to Reduce City Energy Consumption

On August 15, 2001, Mayor Thomas Menino announced a goal of reducing Boston's municipal energy use by 10 percent by 2005. Mayor Menino also established an Advisory Committee on Energy to develop affordability strategies for low- and fixed income households, develop a safety prevention and response plan, find ways to make municipal facilities more efficient with advanced technology, and investigate the use of alternative fuel vehicles in the city motor fleet.

Proposed Actions

Short-term

- Establish a municipal working group on energy management with representatives from the public works, electrical, school, library, community development, and other departments to track energy use in City buildings. Based on the use data, set a municipal goal on reducing energy use. [G]
- Replace incandescent traffic signals with light emitting diode (LED) lights, which are 80 to 90 % more efficient and rated to last 100,000 hours compared to 8,000 hours for incandescents. Take advantage of available utility rebates. [G]
- Recruit businesses and organizations into the federal Energy Star program with the goal of reducing energy use. Utilize pledges, peer exchanges, and public recognition programs to sustain involvement. [G,B,I]
- Work with local stores to promote Energy Star products and educate consumers about the Energy Star label. [G,B]
- Organize "green teams" to promote household practices that reduce GHG emissions. [R,G]
- Organize "green teams" within City departments to promote more sustainable practices in municipal operations. [G]
- Assess the condition of existing buildings to understand the inefficiencies prevalent in the building stock and design appropriate programs to address them. [G]
- Publicize utility energy efficiency programs. [B,G]
- Promote the use of ESCOs and performance contracting, where appropriate, to facilitate energy efficiency improvements when initial financial costs are a barrier. [B, I, G]
- Implement a City purchasing policy favoring Energy Star products. [G]
- Explore options to increase the efficiency of City street lighting. [G]

Medium-term

- Implement an energy management program for municipal facilities to evaluate use patterns, identify opportunities for energy efficiency improvements and renewable energy installations, pursue utility and other outside funding sources, manage contract work, and evaluate options for the energy supply. Consider establishment of an energy management position. [G]
- Integrate energy efficiency upgrades and renewable energy installations into the City capital planning process. [G]

Strategy 2: Promote Cleaner and Greener Electricity

While the City does not control how our electricity is made, we can have some influence by supporting local renewable energy installations and green power purchasing choices. This strategy assumes that deregulation will bring cleaner gas-fired generation facilities and renewable energy sources will displace generation based on coal and oil. The transition to cleaner fuels appears to be underway with the construction beginning on new gas-fired facilities in Massachusetts. The emission of CO_2 per kilowatt-hour of electricity is estimated to decrease from 1.54 pounds per year in 1990 to 1.23 pounds per year in 2010.

The opportunity to install and purchase green power is growing. Deregulation provides an opportunity to negotiate not only the price, but also the attributes of electricity supply. Municipalities have the possibility of aggregating consumers to create group buying power. The Massachusetts Renewable Energy Trust has begun to disburse grants and other financing for clean energy projects. Consumers can buy green tags to support green power projects.

Because municipal aggregation automatically includes all electricity consumers in a town or city unless they proactively opt out, pursuing a municipal aggregation would require a significant community process given the differences in costs and benefits to different ratepayers. One possible benefit of municipal aggregation is that the city or town can petition the Massachusetts Department of Telecommunications and Energy (DTE) to grant it control of energy efficiency funds, which are currently controlled by the local utility. The municipality would have to establish and run a program to utilize the funds effectively.[1]

The City is working with the Massachusetts Energy Consumers Alliance, a non-profit organization based in Jamaica Plain, and other municipalities and organizations to assess the feasibility of creating a non-profit consumer aggregation program that would offer electricity that is entirely or partially generated by renewable sources. Such a program would differ from a municipal aggregation by including consumers who voluntarily join. This program would be similar to for-profit and non-profit operations in other states such as Green Mountain Power.

1. Given the current lack of competition in the Massachusetts electricity marketplace, there are few suppliers with which an aggregation can negotiate. Consequently, little activity has taken place to date, but the 21 Cape Cod and Martha's Vineyard communities have formed the Cape Light Compact (CLC). CLC has contracted with Select Energy to provide electricity. However, the contract does not take effect until the standard offer price of electricity reaches a certain level. In the meantime, the CLC offer price of electricity reaches a certain level. In the meantime, the CLC has petitioned the DTE and taken over NSTAR's energy efficiency program. Other aggregations in the state include the Health Education Facilities Authority "Power Option" program, which includes many hospitals and other entities, and the aggregation the Massachusetts Municipal Association offers to local governments.

Currently, the only way most consumers can purchase green power is through green tags, which are the difference in cost between conventional energy and a renewable source. For example, if energy from the local utility costs 10 cents a kwh and energy from a wind generator costs 12 cents, a green tag for that would be valued at 2 cents. A person, business, or organization would buy green tags to offset the environmental costs of their electricity use. In Massachusetts, Conservation Services Group markets a green tag product called ReGen, which is used to pay for installation of solar, wind, and landfill gas projects that generate electricity. ReGen provides 2,000 kwh blocks of clean energy which anyone can buy.

The Massachusetts Renewable Energy Trust receives the proceeds of the system benefits charges paid by consumers and collected by utilities. To date about $150 million has been collected. Some of the funds are earmarked for one-time grants to communities tied by contract to purchase power generated by waste incineration.

MRET has issued solicitations for the following areas:

- ***Green buildings***—to promote the installation of photovoltaic solar panels on energy efficient buildings.
- ***Premium power***—to promote the installation of fuel cells to provide electricity at higher levels of reliability compared to conventional sources.
- ***Renewable energy planning***—to support planning for the installation and marketing of wind and other distributed energy systems.
- ***Consumer aggregation planning***—to support planning for efforts to pool electricity consumers for green power purchasing.
- ***Green schools***—to promote the design and construction of high performance school buildings.

These funds are offered on a competitive basis. The City has received funding for a photovoltaic installation on the City Hall Annex roof.

Newton Sunergy Project

The City of Newton joined the U.S. Department of Energy's Million Solar Roofs Partnership in the spring of 2000. Newton has pledged to create 500 new solar projects, by adding solar collectors on public buildings and promoting the use of solar energy by private organizations and citizens.

The City has surveyed property owners to assess the potential to install solar energy systems and is working to facilitate installations.

The Renewable Energy Trust recently awarded Newton a grant of $115,200 to support the installation of a 60-70 kw photovoltaic system on Newton South High School.

Actions: 1990-2001

- Gravestar installed 20 kw of solar photovoltaic (PV) panels on Porter Square Shopping Plaza and 6 kw of PV panels on the Greenworks building at 160 Second Street.
- The Union of Concerned Scientists installed 2.1 kw of PV panels on their headquarters building in Harvard Square. The top three floors, which UCS owns, were outfitted with green building technology. UCS also buys green tags to offset 100% of the emissions associated with its electricity use.
- The state installed 12 kw of PV on the Alewife Station Parking Garage to offset the power used at six electric car recharging stations. The recharging stations are part of a Division of Energy Resources electric vehicle demonstration program. The system produces a surplus of power, which is sold to the regional electricity grid.
- The Massachusetts Energy Consumers Alliance, the City of Cambridge, other municipalities, and organizations partnered to undertake a feasibility study of green power consumer aggregation. The Massachusetts Renewable Energy Trust and the Merck Foundation awarded grants to support the project. The study will be completed in the summer of 2002.
- MIT constructed a cogeneration facility in 1995 to replace electricity from the regional grid and steam from on-campus boilers.
- Mirant acquired the Kendall Square Station power plant in 1999 and upgraded it with a combined cycle gas-fired generator.

Cities Go for Green Power

- *Santa Monica, California purchases 100% of the electricity used by the municipal government from renewable sources.*
- *The City of Chicago has contracted with Consolidated Edison to purchase 10% of its municipal electricity from renewable sources in the first year of the contract and 20% within 5 years.*
- *The City of Los Angeles is purchasing 10% of its municipal power needs from renewable sources.*

Proposed Actions

Short-term

- Join Solar Boston, a partnership of the U.S. Department of Energy, solar energy businesses, and local community organizations, to promote and facilitate solar energy installations. [G]
- Pursue funding of solar energy installations through the Massachusetts Renewable Energy Trust. [B,G,I]
- Install solar energy systems on City facilities. [G]

Medium-term

- Develop funding sources for solar energy installations in partnership with NSTAR to address distribution system bottlenecks and RPS requirements. [B,G]
- Develop one or more projects with schools to install solar energy systems and conduct associated classroom activities. [G, I]
- Support implementation of the Clean Air Act regulations on older power plants. Advocate for a federal renewable portfolio standards. [G,R]

Long-term

- Support federal action on lowering power plant emissions of CO_2 and conventional air pollutants. [G,R]

Strategy 3: Increase Use of East Cambridge District Steam

Cogeneration facilities, such as the ones at Kendall Square Station and MIT, increase the efficiency of power plants by recovering the waste heat from the electric generators and using it to heat and cool buildings and provide chilled water for various processes. This prevents GHG emissions by avoiding the use of natural gas and oil to heat and electricity to cool buildings.

Mirant estimates that steam from the new generator at Kendall Square Station will involve 0.15 pounds less $C0_2$ emissions per pound of steam than steam produced by individual boilers typically found in commercial buildings. Existing buildings can be converted to the district system and new buildings can be tied in from the start.

Currently AES supplies approximately 400 million pounds of steam annually to its East Cambridge customers from the Kendall Square power plant. AES estimates that there is a reasonable potential to increase the demand with the existing distribution system to 600 million pounds of steam annually.

Proposed Actions

Medium-term

- Add additional customers to the East Cambridge steam system and increase steam use by 200 million pounds annually. [B]
- Extend the steam distribution system to the North Point area, which is slated for development. [B,G]